**Documentation of Environmental Indicator Determination**
**in accordance with EPA Interim Final Guidance 2/5/99**

**RCRA Corrective Action**
**Environmental Indicator (EI) RCRIS code (CA750)**

**Migration of Contaminated Groundwater Under Control**

Facility Name: MEMC Electronic Materials Company
Facility Address: 501 Pearl Drive (city of O'Fallon) P.O. Box 8, St. Peters, MO 63376
Facility EPA ID #: MOD001700673

1. Has **all** available relevant/significant information on known and reasonably suspected releases to the groundwater media, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been **considered** in this EI determination?

   __X__ If yes - check here and continue with #2 below.

   _____ If no - re-evaluate existing data, or

   _____ If data are not available, skip to #8 and enter "IN" (more information needed) status code.

## BACKGROUND

### Definition of Environmental Indicators (for RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EIs developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

### Definition of "Migration of Contaminated Groundwater Under Control" EI

A positive "Migration of Contaminated Groundwater Under Control" EI determination ("YE" status code) indicates that the migration of "contaminated" groundwater has stabilized, and that monitoring will be conducted to confirm that contaminated groundwater remains within the original "area of contaminated groundwater" (for all groundwater "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

## Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program the EIs are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, GPRA). The "Migration of Contaminated Groundwater Under Control" EI pertains ONLY to the physical migration (i.e., further spread) of contaminated groundwater and contaminants within groundwater (e.g., non-aqueous phase liquids or NAPLs). Achieving this EI does not substitute for achieving other stabilization or final remedy requirements and expectations associated with sources of contamination and the need to restore, wherever practicable, contaminated groundwater to be suitable for its designated current and future uses.

## Duration / Applicability of EI Determinations

EI Determination status codes should remain in RCRIS national database ONLY as long as they remain true (i.e., RCRIS status codes must be changed when the regulatory authorities become aware of contrary information).

2. Is **groundwater** known or reasonably suspected to be **"contaminated"**[1] above appropriately protective "levels" (i.e., applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria [e.g, Maximum Contaminant Levels (MCLs), the maximum permissible level of a contaminant in water delivered to end users of a public water system under the Safe Drinking Water Act]) from releases subject to RCRA Corrective Action, anywhere at, or from, the facility?

   __X__ If yes - continue after identifying key contaminants, citing appropriate "levels," and referencing supporting documentation.

   _____ If no - skip to #8 and enter "YE" status code, after citing appropriate "levels," and referencing supporting documentation to demonstrate that groundwater is not "contaminated."

   _____ If unknown - skip to #8 and enter "IN" status code.

   Rationale and Reference(s): The key contaminants are 1,1-DCE, 1,2-DCE (total), TCE, Vinyl Chloride, and Freon-113. The Groundwater Protection Standards (GPS) for these contaminants are (See attached page 2-5 and Table 2-1 from the Corrective Measures Study Report (CMS). The GPS are also contained in page 8-1 and Table 8-1 from the RCRA Facility Investigation (RFI) dated April 23, 1993; Table 2-1 from the Corrective Measures Implementation Plans (CMI) dated April of 1997; and also in Table 1 of the Final Decision document dated April 21, 1995.) 1,1-DCE 7ug/L, 1,2-DCE 70ug/L, TCE 5ug/L, and Vinyl Chloride 2ug/L, there is no GPS for Freon-113.

   During 1998 there were 22 monitoring wells that had detections that exceeded the GPS levels. (See attached tables 5-4 through 5-8 from the *Annual RCRA Groundwater Quality Assessment Report for 1998 (AGWR)*.)

Footnotes:

[1] "Contamination" and "contaminated" describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriate "levels" (appropriate for the protection of the groundwater resource and its beneficial uses).

3. Has the **migration** of contaminated groundwater **stabilized** (such that contaminated groundwater is expected to remain within "existing area of contaminated groundwater"[2] as defined by the monitoring locations designated at the time of this determination)?

   __X__ If yes - continue, after presenting or referencing the physical evidence (e.g., groundwater sampling/measurement/migration barrier data) and rationale why contaminated groundwater is expected to remain within the (horizontal or vertical) dimensions of the "existing area of groundwater contamination"[2]).

   _____ If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the "existing area of groundwater contamination"[2]) - skip to #8 and enter "NO" status code, after providing an explanation.

   _____ If unknown - skip to #8 and enter "IN" status code.

   Rationale and Reference(s): The contaminated groundwater is currently within MEMC's property lines. The use of pump and treat ensures that the groundwater contamination is contained. The horizontal and vertical extent of the contamination is defined and continues to be monitored through groundwater sampling and analysis from monitoring wells, sumps, and pumping wells. (See attached Figures 5-1 through 5-10 and Figures 5-12 through 5-16 for horizontal and vertical delineation of the contaminated groundwater in the AGWR for 1998.) Continued groundwater monitoring is required by the approved CMI dated April of 1997.

[2] "existing area of contaminated groundwater" is an area (with horizontal and vertical dimensions) that has been verifiably demonstrated to contain all relevant groundwater contamination for this determination, and is defined by designated (monitoring) locations proximate to the outer perimeter of "contamination" that can and will be sampled/tested in the future to physically verify that all "contaminated" groundwater remains within this area, and that the further migration of "contaminated" groundwater is not occurring. Reasonable allowances in the proximity of the monitoring locations are permissible to incorporate formal remedy decisions (i.e., including public participation) allowing a limited area for natural attenuation.

4. Does “contaminated” groundwater **discharge** into **surface water** bodies?

_____ If yes - continue after identifying potentially affected surface water bodies.

__X__ If no - skip to #7 (and enter a “YE” status code in #8, if #7 = yes) after providing an explanation and/or referencing documentation supporting that groundwater “contamination” does not enter surface water bodies.

_____ If unknown - skip to #8 and enter “IN” status code.

Rationale and Reference(s): A surface water and sediment investigation was outlined in the RFI Report. The conclusion of the investigation was that a CMS for surface water and sediment wasn’t necessary. (See attached pages 7-29 through 7-34 of the RFI).

In the Final Decision document dated April 21, 1995, it states that the concentrations of hazardous constituents in the surface water, surface water sediments, soil, and air at the Facility do not pose a significant risk to human health and the environment and do not exceed action levels.

Currently groundwater is extracted using a recovery well system and is treated with an on-site air stripping system. The effluent is then discharged from the air stripper unit to Belleau Creek via the National Pollutant Discharge Elimination System (NPDES) permitted outfall, or to the local publicly owned wastewater treatment works (POTW). It should be noted that this is treated water, not contaminated.

In the attached Figures 5-2 and 5-4 from AGWR for 1998, it may appear that contaminated groundwater could be discharging into MEMC Lake. The monitoring wells in the variably saturated zone located closest to MEMC Lake are MW-01, MW-12, and MW-25A. The levels of 1,2-DCE (total) detected in these wells from 1997 to 1998 (See AGWR for 1997 and AGWR for 1998) decreased from 0.075 mg/L to 0.043 mg/L in MW-01, from 0.015 mg/L to 0.013 mg/L in MW-12, and from 0.84 mg/L to 0.74 mg/L in MW-25A. Of these three wells, MW-25 was the only one with detections above GPS levels.

The levels of vinyl chloride detected in these wells were no detections (ND) for MW-01 and MW-12 in both 1997 and 1998, and the levels of vinyl chloride in MW-25A detected in these wells from 1997 to 1998 decreased from 0.069 mg/L to 0.066 mg/L. Again, the only well with detections above GPS levels is MW-25A. (See the attached Figures 5-2 and 5-4 for Question 4 from AGWR for 1998.)

The groundwater flow direction in the vicinity of MEMC Lake is primarily to the north and is captured by pumping well P-9 which had no detections above GPS levels in 1998. Pumping well P-8 captures the groundwater in the vicinity of MW-25A, which had detections of 1,2-DCE (total), TCE, Freon-113, and vinyl chloride above GPS levels. Because of the absence of VOCs in the pumping well closest to MEMC Lake and because the detection levels in the wells nearest MEMC Lake are decreasing, it is

improbable that contamination is discharging from the groundwater into MEMC Lake.

5. Is the **discharge** of "contaminated" groundwater into surface water likely to be **"insignificant"** (i.e., the maximum concentration[3] of each contaminant discharging into surface water is less than 10 times the appropriate groundwater "level," and there are no other conditions (e.g., the nature or number of discharging contaminants, or environmental setting), which significantly increase the potential for unacceptable impacts to surface water, sediments or eco-systems at these concentrations)?

_____ If yes - skip to enter "YE" status code in #8 if #7 = yes), after documenting: 1) the maximum known or reasonably suspected concentration[3] of key contaminants discharged above their groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) provide a statement of professional judgement/explanation (or reference documentation) supporting that the discharge of groundwater contaminants into the surface water is not anticipated to have unacceptable impacts to the receiving surface water, sediments or eco-system.

_____ If no - (the discharge of "contaminated" groundwater into surface water is potentially significant) - continue after documenting: 1) the maximum known or reasonably suspected concentration [3] of each contaminant discharged above its groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) for any contaminants discharging into surface water in concentrations[3] greater than 100 times the appropriate groundwater "levels," the estimated total amount (mass in kg/yr) of each of these contaminants that are being discharged (loaded) into the surface water body (at the time of the determination), and identify if there is evidence that the amount of discharging contaminants is increasing.

_____ If unknown - enter "IN" status code in #8.

Rationale and Reference(s): Not Applicable

[3] As measured in groundwater prior to entry to the groundwater-surface water/sediment interaction (e.g., hyporheic) zone.

6. Can the **discharge** of "contaminated" groundwater into surface water be shown to be "**currently acceptable**" (i.e., not cause impacts to surface water, sediments or eco-systems that should not be allowed to continue until a final remedy decision can be made and implemented[4])?

_____ If yes - continue after either: 1) identifying the Final Remedy decision incorporating these conditions, or other site-specific criteria (developed for the protection of the site's surface water, sediments, and eco-systems),

and referencing supporting documentation demonstrating that these criteria are not exceeded by the discharging groundwater; OR 2) providing or referencing an interim-assessment,[5] appropriate to the potential for impact, that shows the discharge of groundwater contaminants into the surface water is (in the opinion of a trained specialist(s), including ecologist) adequately protective of receiving surface water, sediments, and eco-systems, until such time when a full assessment and final remedy decision can be made. Factors which should be considered in the interim-assessment (where appropriate to help identify the impact associated with discharging groundwater) include: surface water body size, flow, use/classification/habitats and contaminant loading limits, other sources of surface water/sediment contamination, surface water and sediment sample results and comparisons to available and appropriate surface water and sediment "levels," as well as any other factors, such as effects on ecological receptors (e.g., via bio-assays/benthic surveys or site-specific ecological Risk Assessments), that the overseeing regulatory agency would deem appropriate for making the EI determination.

_____ If no - (the discharge of "contaminated" groundwater cannot be shown to be "**currently acceptable**") - skip to #8 and enter "NO" status code, after documenting the currently unacceptable impacts to the surface water body, sediments and/or eco-systems.

_____ If unknown - skip to 8 and enter "IN" status code.

Rationale and Reference(s): Not Applicable

[4] Note, because areas of inflowing groundwater can be critical habitats (e.g., nurseries or thermal refugia) for many species, appropriate specialist (e.g., ecologist) should be included in management decisions that could eliminate these areas by significantly altering or reversing groundwater flow pathways near surface water bodies.

[5] The understanding of the impacts of contaminated groundwater discharges into surface water bodies is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration to be reasonably certain that discharges are not causing currently unacceptable impacts to the surface waters, sediments or eco-systems.

7. Will groundwater **monitoring** / measurement data (and surface water/sediment/ecological data, as necessary) be collected in the future to verify that contaminated groundwater has remained within the horizontal (or vertical, as necessary) dimensions of the "existing area of contaminated groundwater?"

_X_ If yes - continue after providing or citing documentation for planned

activities or future sampling/measurement events. Specifically identify the well/measurement locations which will be tested in the future to verify the expectation (identified in #3) that groundwater contamination will not be migrating horizontally (or vertically, as necessary) beyond the "existing area of groundwater contamination."

_____ If no - enter "NO" status code in #8.

_____ If unknown - enter "IN" status code in #8.

Rationale and Reference(s): The CMI provides, among other things, an Operation and Maintenance Plan (O&M Plan) and a Sampling and Analysis Plan (SAP Plan) for the continued sampling and analysis of groundwater at the Facility. Sampling and analysis is performed quarterly and is reported to MDNR and EPA on a quarterly, semi-annually, and an annual basis. MDNR performs an annual assessment of the *Annual RCRA Groundwater Quality Assessment Reports.* As a result, the CMI provides for continued monitoring by the MEMC and continued report and oversight by MDNR.

In the Final Decision document dated April 21, 1995, it states that the concentrations of hazardous constituents in the surface water, surface water sediments, soil and air at the Facility do not pose a significant risk to human health and the environment and do not exceed action levels. Subsequently there is no current need to monitor these mediums other than NPDES sampling and analysis.

Collection and analysis of ecological data is also not deemed necessary. A risk assessment was performed and is available in the RFI.

8. Check the appropriate RCRIS status codes for the Migration of Contaminated Groundwater Under Control EI (event code CA750), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (attach appropriate supporting documentation as well as a map of the facility).

X YE - Yes, "Migration of Contaminated Groundwater Under Control" has been verified. Based on a review of the information contained in this EI determination, it has been determined that the "Migration of Contaminated Groundwater" is "Under Control" at the MEMC Electronic Materials Company facility, EPA ID # MOD001700673, located at 501 Pearl Drive (city of O'Fallon) P.O. Box 8, St. Peters, MO 63376. Specifically, this determination indicates that the migration of "contaminated" groundwater is under control, and that monitoring will be conducted to confirm that contaminated groundwater remains within the "existing area of contaminated groundwater." This determination will be re-evaluated when the Agency becomes aware of significant changes at the facility.

_____ NO - Unacceptable migration of contaminated groundwater is observed or expected.

_____ IN - More information is needed to make a determination.

Completed by: (Signature) Original signed by Jessica A. Thomas Date: 9/30/99
(Print) Jessica A. Thomas
(Title) Environmental Engineer

Supervisor: (Signature) Original signed by R Bruce Stuart Date: 9/30/99
(Print) R Bruce Stuart
(Title) Chief, Groundwater Unit

Completed by: (Signature) Original signed by Kenneth S. Ritchey Date: 9/30/99
(Print) Kenneth S Ritchey
(Title) Environmental Scientist
(EPA Region or State) EPA Region VII

Supervisor: (Signature) Original signed by William Pedicino Date: 9/30/99
(Print) William Pedicino
(Title) Chief RCRA Branch
(EPA Region or State) Region 7

Locations where References may be found: The CMI, RFI, Final Decision document, and *Annual RCRA Groundwater Quality Assessment Report for 1998* is available in the MDNR MEMC File, the EPA MEMC File, and in the O'Fallon Branch Library (located at 130 O'Fallon Plaza).

Contact telephone and e-mail numbers

(Name) Jessica A. Thomas
(Phone #) (573) 751-3553
(E-mail) NRTHOMJ@mail.dnr.state.mo.us

(Name) K. Scott Ritchey
(Phone #) (913) 551-7641
(E-mail) ritchey.scott@epamail.epa.gov

Ref: ***ca750epa.doc***